Topic: Sales decline

Question: A t-shirt company noticed that their inventory of blue shirts was declining exponentially at a rate of $23\,\%$ per year. They currently have 300 blue shirts in stock and they don't plan to purchase any more. How many blue shirts will they have in stock in 3 years?

Answer choices:

A 250

B 200

C 150

D 100

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Solution: C

We can use the exponential decay equation

$$S(t) = S_0 e^{-\lambda t}$$

where $S(t)$ is the final amount after time t, S_0 is the initial amount, and λ is the rate of decline.

Remember to make sure that rate of decline and time are in the same units (if your rate of decline is annual, time should be in years).

$$S(t) = 300e^{-0.23(3)}$$

$$S(t) = 150$$

The t-shirt store will have 150 blue t-shirts left in 3 years.

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Topic: Sales decline

Question: The pet store noticed that sales of generic cat food was declining at an exponential rate of $8\,\%$ per year. If they currently sell 600 bags of generic cat food in one year, how many years will it take before they're only selling 100 bags annually?

Answer choices:

A 22.4 years

B 24.4 years

C 24.2 years

D 42.4 years

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Solution: A

We can use the exponential decay equation

$$S(t) = S_0 e^{-\lambda t}$$

where $S(t)$ is the final amount after time t, S_0 is the initial amount, and λ is the rate of decline.

Remember to make sure that rate of decline and time are in the same units (if your rate of decline is annual, time should be in years).

$$100 = 600e^{(-0.08)t}$$

$$\frac{100}{600} = e^{(-0.08)t}$$

$$\frac{1}{6} = e^{(-0.08)t}$$

$$\ln \frac{1}{6} = \ln \left(e^{(-0.08)t}\right)$$

$$\ln \frac{1}{6} = (-0.08)t$$

$$t = \frac{\ln \frac{1}{6}}{-0.08}$$

$$t = 22.4$$

It will take the pet store 22.4 years before they're only selling 100 bags each year.

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Topic: Sales decline

Question: A candy store noticed that sales of pixie sticks were declining. Two years ago, the candy store sold 450 pixie sticks. This year the candy store is selling 150 pixie sticks. Assuming that sales have declined exponentially, what is the annual rate of decline of sales of pixie sticks?

Answer choices:

A $5\,\%$

B $5.50\,\%$

C $0.55\,\%$

D $55\,\%$

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Solution: D

We can use the exponential decay equation

$$S(t) = S_0 e^{-\lambda t}$$

where $S(t)$ is the final amount after time t, S_0 is the initial amount, and λ is the rate of decline.

Remember to make sure that rate of decline and time are in the same units (if your rate of decline is annual, time should be in years).

$$150 = 450e^{-\lambda(2)}$$

$$\frac{150}{450} = e^{-\lambda(2)}$$

$$\frac{1}{3} = e^{-\lambda(2)}$$

$$\ln\frac{1}{3} = \ln\left(e^{-\lambda(2)}\right)$$

$$\ln\frac{1}{3} = -\lambda(2)$$

$$\lambda = \frac{\ln\frac{1}{3}}{-2}$$

$$\lambda = 0.55$$

The annual rate of sales decline of the pixie sticks is $55\,\%$.

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